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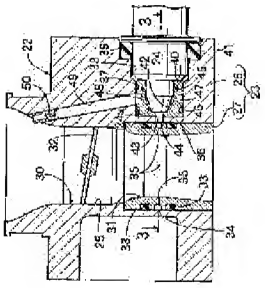
(54) FUEL SUPPLY DEVICE FOR ENGINE



(57)Abstract:
PROBLEM TO BE SOLVED: To further accelerate fuel atomization, in a fuel supply device for engines, in which a fuel injection valve is secured to an intake passage forming body forming the intake passage, and which is provided with a fuel passage for introducing the fuel from the fuel injection valve, a fuel suction port, with one end communicated with the fuel passage and the other end communicated with the intake passage, and an air bleed passage with one end communicated with the intake passage at the upperstream side of the fuel suction port and the other end communicated with the fuel passage.
SOLUTION: The fuel suction port 35 is opened to the intake passage 30 in the direction orthogonal to air flow orthogonal to the intake passage 30.

LEGAL STATUS

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CLAIMS

[Claim(s)]

[Claim 1] The fuel path to which the inhalation-of-air way organizer (23) which forms the inhalation-of-air way (30) which leads to an air cleaner (29) is equipped with a fuel injection valve (24), and the fuel from said fuel injection valve (24) is led (34), Fuel extrusion opening which makes the other end lead to said inhalation-of-air way (30) while making an end lead to this fuel path (34) (35), The air-bleed path (49) which made the other end lead to said fuel path (34) while making an end lead to an inhalation-of-air way (30) by the upstream from said fuel extrusion opening (35) The fuel supply system of the engine characterized by carrying out opening to said inhalation-of-air way (30) towards intersecting perpendicularly with the airstream to which the

other end of said fuel extrusion opening (35) circulates said inhalation-of-air way (30) in the fuel supply system of the engine prepared in said inhalation-of-air way organizer (23).
[Claim 2] The fuel supply system of the engine according to claim 1 characterized by for said fuel extrusion opening (35) carrying out opening to the inner skin of an inhalation-of-air way (30), and preparing it in an inhalation-of-air way organizer (23).
[Claim 3] The fuel supply system of the engine according to claim 2 characterized by carrying out opening of the other end of two or more of said fuel extrusion openings (35) to the inner skin of said inhalation-of-air way (30) in the location which countered mutually.
[Claim 4] The fuel path to which the inhalation-of-air way organizer (23) which forms the inhalation-of-air way (30) which leads to an air cleaner (29) is equipped with a fuel injection valve (24), and the fuel from said fuel injection valve (24) is led (34), Fuel extrusion opening which makes the other end lead to said inhalation-of-air way (30) while making an end lead to this fuel path (34) (35), The air-bleed path (49) which made the other end lead to said fuel path (34) while making an end lead to an inhalation-of-air way (30) by the upstream from said fuel extrusion opening (35) In the fuel supply system of the engine prepared in said inhalation-of-air way organizer (23) From the inhalation-of-air way (30) of the upstream of this converging section (31), the converging section (31) which constitutes said a part of inhalation-of-air way (30) makes an inner circumference diameter small, and is formed in said inhalation-of-air way organizer (23). The fuel supply system of the engine characterized by carrying out opening of the other end of said fuel extrusion opening (35) to the inner skin of said converging section (31) towards intersecting perpendicularly with the airstream which circulates said converging section (31).

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] The fuel path to which the inhalation-of-air way organizer which forms the inhalation-of-air way where this invention leads to an air cleaner is equipped with a fuel injection valve, and the fuel from said fuel injection valve is led, Fuel extrusion opening which makes the other end lead to said inhalation-of-air way while making an end lead to this fuel path, The air-bleed path which made the other end lead to said fuel path while making an end lead to an inhalation-of-air way by the upstream rather than said fuel extrusion opening is related with the fuel supply system of the engine prepared in said inhalation-of-air way organizer.

[0002]

[Description of the Prior Art] Conventionally, this fuel supply system is already known for JP,5-26132,A etc.

[0003]

[Problem(s) to be Solved by the Invention] By the way, such a fuel supply system makes it unnecessary to control the fuel-injection timing of a fuel injection valve with high precision while making it possible to promote atomization of a fuel with the assistant air from an air-bleed path, and to reduce the injection pressure of a fuel injection valve, while sucking out and atomizing the fuel supplied from a fuel injection valve by the airstream which circulates an inhalation-of-air way. however -- in the above-mentioned conventional thing, opening of the fuel extrusion opening is carried out towards the flow direction downstream of the airstream in an inhalation-of-air way, and atomization of the fuel in the inside of airstream is good -- saying -- hard -- reduction of fuel consumption, and exhaust air -- in order to aim at the improvement and the improvement in engine power in description, to promote atomization of a fuel further is desired.

[0004] This invention is made in view of this situation, and aims at offering the fuel supply system of the engine which enabled it to promote atomization of a fuel further.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 The fuel path to which the inhalation-of-air way organizer which forms the inhalation-of-air way which leads to an air cleaner is equipped with a fuel injection valve,

and the fuel from said fuel injection valve is led, Fuel extrusion opening which makes the other end lead to said inhalation-of-air way while making an end lead to this fuel path, In the fuel supply system of the engine with which the air-bleed path which made the other end lead to said fuel path while making an end lead to an inhalation-of-air way by the upstream rather than said fuel extrusion opening is established in said inhalation-of-air way organizer The other end of said fuel extrusion opening is characterized by carrying out opening to said inhalation-of-air way towards intersecting perpendicularly with the airstream which circulates said inhalation-of-air way.

[0006] while becoming possible to reduce fuel consumption by airstream and the fuel sucked out of fuel extrusion opening at an airstream side colliding mutually, a fuel being atomized effectively, and atomization of a fuel being promoted by carrying out opening towards the airstream of an inhalation-of-air way and fuel extrusion opening crossing at right angles according to the configuration of such invention according to claim 1 -- exhaust air -- it becomes possible to improve description and engine power.

[0007] moreover, invention according to claim 2 -- the configuration of invention of the claim 1 above-mentioned publication -- in addition, it is characterized by for said fuel extrusion opening carrying out opening to the inner skin of an inhalation-of-air way, and preparing it in an inhalation-of-air way organizer, and according to this configuration, the structure which bars flow is not established in an inhalation-of-air way with arrangement of fuel extrusion opening, increase of ventilation resistance can be avoided, and engine power can be improved further.

[0008] Are characterized by carrying out opening of the invention according to claim 3 to the inner skin of said inhalation-of-air way in the location where the other end of two or more of said fuel extrusion openings countered mutually in addition to the configuration of invention of the claim 2 above-mentioned publication, and according to this configuration By making the fuels sucked out of fuel extrusion opening which countered mutually at the airstream side collide if a fuel can be atomized much more effectively and fuel consumption is reduced further, preventing that a fuel adheres to the inner skin of an inhalation-of-air way, while ** will become possible -- exhaust air -- description and engine power can be improved further.

[0009] The fuel path to which the inhalation-of-air way organizer which forms the inhalation-of-air way where invention according to claim 4 leads to an air cleaner is equipped with a fuel injection valve, and the fuel from said fuel injection valve is furthermore led, Fuel extrusion

opening which makes the other end lead to said inhalation-of-air way while making an end lead to this fuel path, In the fuel supply system of the engine with which the air-bleed path which made the other end lead to said fuel path while making an end lead to an inhalation-of-air way by the upstream rather than said fuel extrusion opening is established in said inhalation-of-air way organizer The converging section which constitutes said a part of inhalation-of-air way makes an inner circumference diameter smaller than the inhalation-of-air way of the upstream of this converging section, it is prepared in said inhalation-of-air way organizer, and the other end of said fuel extrusion opening is characterized by carrying out opening to the inner skin of said converging section towards intersecting perpendicularly with the airstream which circulates said converging section.

[0010] By carrying out opening to the inner skin of a converging section towards the airstream of an inhalation-of-air way and fuel extrusion opening crossing at right angles according to the configuration of such invention according to claim 4 It becomes possible to suck a fuel out of fuel extrusion opening effectively to an airstream side with the inhalation-of-air negative pressure in a converging section. Airstream, while becoming possible to make the fuel sucked out collide mutually and to atomize a fuel more effectively and becoming possible to reduce fuel consumption -- exhaust air -- it becomes possible to improve description and engine power.

[0011]

[Embodiment of the Invention] Hereafter, it explains based on the example of this invention which showed the gestalt of operation of this invention to the attached drawing.

[0012] the notch side elevation in which drawing 1 - drawing 6 show the 1st example of this invention, and drawing 1 shows an engine inhalation-of-air system, and drawing 2 -- the enlarged vertical longitudinal sectional view of an inhalation-of-air way organizer, and drawing 3 -- the 3-3 line sectional view of drawing 2 , and drawing 4 -- a fuel supply pressure and exhaust air -- drawing and drawing 5 which show the relation of description -- fuel-injection timing and exhaust air -- drawing and drawing 6 which show the relation of description -- brake mean effective pressure and exhaust air -- it is drawing showing the relation of description.

[0013] In drawing 1 , a combustion chamber 15 is first formed between the piston 14 fitting of the sliding of is made free to the cylinder bore 13 with which Engine E is equipped with a cylinder block 11 and the cylinder head 12 combined with this cylinder block 11, and a cylinder

block 11 is equipped, and the cylinder head 12.
[0014] While the suction port 16 and the exhaust air port 17 which can be open for free passage to a combustion chamber 15 are established in the cylinder head 12, bearing of the closing motion actuation of the exhaust valve 19 which switches the free passage and cutoff between the inlet valve 18 which switches the free passage and cutoff between a suction port 16 and a combustion chamber 15, the exhaust air port 17, and a combustion chamber 15 is made possible, and the closing motion drive of an inlet valve 18 and the exhaust valve 19 is conventionally carried out by the well-known valve gear 20.
[0015] A fuel supply system 22 is connected to said suction port 16 through an inlet pipe 21. This fuel supply system 22 is equipped with the inhalation-of-air way organizer 23 and the fuel injection valve 24 with which this inhalation-of-air way organizer 23 is equipped.
[0016] In drawing 2 , the inhalation-of-air way organizer 23 consists of the inhalation-of-air way main formation member 26 which has a path 25, and the converging section material 27 which fitting is carried out to the downstream of said path 25, and is fixed to the inhalation-of-air way main formation member 26, and this inhalation-of-air way organizer 23 is equipped with the inhalation-of-air way 30 where a down-stream edge is opened for free passage by the inlet pipe 21 while an upper edge is opened for free passage by the air cleaner 29 through the inhalation-of-air hose 28. The inhalation-of-air way 30 consists of a part except the part to which fitting of the converging section material 27 is carried out, and a converging section 31 formed by the inside of the converging section material 27 among said paths 25, and rather than this converging section 31, a converging section 31 makes an inner circumference diameter small, the inhalation-of-air way 30 25, i.e., the path, of the upstream, and is formed.
[0017] Bearing of the throttle valve 32 of the butterfly form which controls the opening of the inhalation-of-air way 30 is carried out to the inhalation-of-air way main formation member 26 of the inhalation-of-air way organizer 23 rotatable by the upstream rather than said converging section 31.
[0018] While referring to drawing 3 collectively and establishing a circular sulcus in the periphery of the converging section material 27 It is equipped with the annular seal members 33 and 33 of the pair which faces across the circular sulcus from both sides. Between the converging section material 27 and the inhalation-of-air way main formation member 26, the annular fuel path 34 is formed in the inhalation-of-air way main formation member 26 of said circular sulcus in fitting and the condition

of having fixed, in the converging section material 27. The seal of the both sides of this fuel path 34 is carried out by the seal members 33 and 33 infixed between the inhalation-of-air way main formation member 26 and the converging section material 27. That is, the annular fuel path 34 which surrounds the inhalation-of-air way 30 to this alignment in the part corresponding to a converging section 31 is established in the inhalation-of-air way organizer 23.

[0019] The plurality 35, for example, four fuel extrusion openings, which carries out opening of the other end to the inside of a converging section 31 while making an end lead to the converging section material 27 to the fuel path 34, and 35 -- are those fuel extrusion openings 35 and 35. -- It is made counter mutually other end opening, made and prepared. And each fuel extrusion opening 35 and 35 -- are arranged in the flat surface which intersects perpendicularly with the axis of a converging section 31, and opening is carried out to the inside of a converging section 31 towards intersecting perpendicularly to the flow direction of airstream of each fuel extrusion opening 35 and 35 -- where the other end circulates a converging section 31.

[0020] In the inhalation-of-air way main formation member 26 in the inhalation-of-air way organizer 23, into the part corresponding to the converging section material 27 The minor diameter hole 37 which has an end wall 36 at an inner edge, and the bore hole 38 while being formed at a major diameter and making an inner edge stand in a row in the outer edge of the minor diameter hole 37 rather than this minor diameter hole 37 at the same axle, While being formed in a major diameter and making an inner edge stand in a row on the same axle in the outer edge of the inside bore hole 38 rather than the bore hole 38 in this, the major-diameter hole 39 which carried out opening of the outer edge is formed, and fitting of the color 40 of the shape of a closed-end cylinder which closed the inner edge is carried out to the minor diameter hole 37.

[0021] The point of a fuel injection valve 24 makes the annular seal member 41 intervene between the major-diameter holes 39, and is inserted in said inside bore hole 38 and the major-diameter hole 39. And fitting of the fuel jet nozzle 24a of the shape of a cylinder with which a fuel injection valve 24 is equipped at a tip is carried out to said color 40.

[0022] The bleeding room 42 is formed between fuel jet nozzle 24a and a color 40, and this bleeding room 42 is opened for free passage by the fuel path 34 through the free passage hole 43 prepared in the tip lock out section of a color 40, and the free passage hole 44 which made it this free passage hole 43 and the same axle, and was prepared in the end wall 36. And the annular seal member 45 is infixed among heel [of a

color 40], and fuel jet nozzle 24a, and the toe external surface of a color 40 is equipped with the annular seal member 46 which from-cartridge-contacts the inside of the minor diameter hole 37.
[0023] The annular crevice for forming the annular room 47 between the insides of the minor diameter hole 37 is established in the pars intermedia external surface of a color 40, and two or more free passage holes 48 and 48 -- which make between the annular room 47 and the bleeding room 42 open for free passage are prepared in a color 40.
[0024] In the upstream and this example, the air-bleed path 49 which makes an end lead to the inhalation-of-air way 30 makes that other end lead to said annular room 47 in the inhalation-of-air way main formation member 26 of the inhalation-of-air way organizer 23, makes it to it, and is prepared by the throttle valve 32 by the upstream, rather than said each fuel extrusion opening 35 and 35 -- at it, and an air jet 50 is pressed fit in the end section of this air-bleed path 49. That is, the other end of the air-bleed path 49 which made the inhalation-of-air way 30 of the upstream open an end for free passage through an air jet 50 rather than a throttle valve 32 is open for free passage to the fuel path 34 through the annular room 47, the free passage hole 48, 48 --, and the bleeding room 42 and the free passage holes 43 and 44.
[0025] Next, if an operation of this 1st example is explained, it will be mixed with the assistant air supplied from the air-bleed path 49, and it will be led to the fuel path 34, the fuel injected from a fuel injection valve 24 being measured with an air jet 50 in the bleeding room 42, and will be sucked out and atomized from each fuel extrusion opening 35 and 35 -- by the airstream which circulates the inhalation-of-air way 30 on the inhalation-of-air way 30. And the airstream which opening of each fuel extrusion opening 35 and 35 -- is carried out to the inhalation-of-air way 30 towards intersecting perpendicularly with the airstream which circulates the inhalation-of-air way 30, and circulates the inhalation-of-air way 30, By the fuel extrusion opening 35 and the fuel sucked out of 35 -- at an airstream side colliding mutually, a fuel being atomized effectively, and atomization of a fuel being promoted while becoming possible to reduce the fuel consumption of Engine E -- exhaust air -- it becomes possible to improve description and engine power.
[0026] Moreover, since the fuel extrusion opening 35 and 35 -- are carrying out opening to the inner skin of the inhalation-of-air way 30, the structure of the fuel extrusion opening 35 and 35 -- which bars flow is not established in the inhalation-of-air way 30 with arrangement. Therefore, increase of the ventilation resistance in the inhalation-of-

air way 30 can be avoided, and engine power can be improved further.
[0027] Since opening of the fuel extrusion opening 35 and 35 -- is furthermore carried out to the inner skin of the inhalation-of-air way 30 in the location which countered mutually By making the fuel extrusion opening 35 which countered mutually, and the fuels which were sucked out of 35 -- at the airstream side collide if a fuel can be atomized much more effectively and fuel consumption is reduced further, preventing that a fuel adheres to the inner skin of the inhalation-of-air way 30, while ** will become possible -- exhaust air -- description and engine power can be improved further.
[0028] Rather than this converging section 31, the converging section 31 which constitutes a part of especially inhalation-of-air way 30 makes an inner circumference diameter smaller than the inhalation-of-air way 30 of the upstream, and is formed in the inhalation-of-air way organizer 23. Since opening of the fuel extrusion opening 35 and 35 -- is carried out to the inner skin of a converging section 31 towards intersecting perpendicularly with the airstream which circulates a converging section 31 while the inhalation-of-air negative pressure in a converging section 31 enables it to suck out a fuel more effectively to an airstream side from the fuel extrusion opening 35 and 35 -- and becoming possible to reduce fuel consumption further -- exhaust air -- it becomes possible to improve description and engine power further.
[0029] exhaust air of the fuel supply system 22 according to such this invention, and the fuel supply system 22 only by the fuel injection from a fuel injection valve -- description If a fuel supply pressure is changed in the operational status of engine-speed 4000rpm and brake-mean-effective-pressure Pme400kPa and being compared As opposed to description being acquired spraying which can hold down HC concentration in exhaust gas to about 180 ppm equivalent to the conventional carburetor even if it reduces the fuel supply pressure to a fuel injection valve 24 to near the 0kPa in the fuel supply system 22 which comes to show by drawing 4 and follows this invention -- In the fuel supply system 22 only by the fuel injection from a fuel injection valve, a fuel supply pressure is [250kPa(s)] lower limits. That is, to the ability not to fully atomize a fuel, if a fuel supply pressure is not set as 250 or more kPas, the fuel supply only by the fuel injection from a fuel injection valve enables it to fully atomize a fuel with the fuel supply system 22 according to this invention, even if it reduces a fuel supply pressure to near the 0kPa.
[0030] Therefore, while becoming possible to aim at miniaturization of the fuel pump connected to a fuel injection valve 24, and reduction of

power consumption, it becomes possible to aim at the cost cut of the fuel line prepared between a fuel injection valve 24 and a fuel pump. Moreover, a fuel is supplied for a fuel to a fuel injection valve 24 only by head ** from the fuel tank arranged above a fuel injection valve 24, without using a fuel pump, and you may make it measure a fuel by turning on and off of a fuel injection valve 24.

[0031] Thus, since a fuel can fully be atomized, it becomes it is possible to shorten the inhalation-of-air tube length from the inhalation-of-air path organizer 22 to a suction port 16, and possible to attain the miniaturization of the whole engine containing an inhalation-of-air system.

[0032] If a fuel injection valve 24 is the posture which can supply a fuel to the fuel path 34, the inhalation-of-air way organizer 23 may be equipped with it with what kind of posture, and it can increase the degree of freedom on arrangement of a fuel injection valve 24. However, if the inhalation-of-air way organizer 23 is equipped with a fuel injection valve 24 like this example with the posture which intersects perpendicularly with the axis of the inhalation-of-air way 30, the miniaturization of the whole engine which shortens an inhalation-of-air system and contains an inhalation-of-air system can be attained.

[0033] moreover, exhaust air of the fuel supply system 22 according to this invention, and the fuel supply system 22 only by the fuel injection from a fuel injection valve -- when fuel-injection timing (whenever [in front of OTDC / crank angle]) is changed in the operational status of engine-speed 4000rpm and brake-mean-effective-pressure Pme400kPa and description is compared, drawing 5 comes to show. even if it changes the injection timing of a fuel injection valve 24 in the fuel supply system 22 according to this invention so that clearly from this drawing 5 -- exhaust air -- the fuel supply system 22 according only to the fuel injection from a fuel injection valve to there being no change in description -- change of injection timing -- responding -- exhaust air -- description will change. namely, -- since a fuel injection valve 24 should just supply the fuel according to the amount sucked out by the inhalation-of-air way 30, even if a fuel is measured by the inhalation-of-air negative pressure according to the operational status of Engine E, and it is sucked out by the inhalation-of-air way 30, and it does not control the injection timing of a fuel injection valve 24 by the fuel supply system 22 according to this invention with high precision -- a fuel -- enough -- atomizing -- good exhaust air -- acquiring description -- possible -- **. however, in the fuel supply only by the fuel injection from a fuel injection valve, if fuel-injection timing is not

controlled with high precision, sufficient atomization of a fuel obtains -- not having -- exhaust air -- description will also get worse.
[0034] exhaust air of the fuel supply system 22 which furthermore follows this invention, and the fuel supply system 22 only by the fuel injection from a fuel injection valve -- when brake mean effective pressure Pme is changed and is measured, drawing 6 comes to show the operational status which considered the engine speed for description as low rotation of 2000rpm. the time of moreover Engine E being operated with the heavy load by low-speed rotation of 2000rpm with the fuel supply system 22 according to this invention, when brake mean effective pressure Pme is low so that clearly [in this drawing 6] -- a fuel -- enough -- atomizing -- good exhaust air -- the fuel supply according only to the fuel injection from a fuel injection valve to description being acquired -- a fuel -- enough -- it cannot atomize -- exhaust air -- degradation of description will be caused. That is, with the fuel supply system 22 according to this invention, since atomization by assistant air is also performed, the fuel can fully be atomized also by the heavy load and the operational status of low rotation.
[0035] By the way, it sets in the conventional engine which supplied the fuel using the fuel injection valve. According to it being difficult to provide fuel supply with one fuel injection valve over the large operation region from the idle opening of a throttle valve to full open opening, although an additional fuel injection valve may be arranged in the upstream rather than a throttle valve It is also possible to replace with and use the fuel supply system according to this invention for the fuel injection valve of the above-mentioned addition, and the 2nd following example explains the configuration of the inhalation-of-air system in such a case.
[0036] In drawing 7 , the fuel injection valve 52 which mainly provides the fuel which should be supplied to Engine E to the inlet pipe 53 connected to the suction port 16 of Engine E is attached, and an inlet pipe 53 is connected to an air cleaner 29 through a throttle body 51 and fuel supply system 22' equipped with a throttle valve 32.
[0037] Fuel supply system 22' is constituted like the fuel supply system 22 of the 1st example of the above except for a throttle valve not being prepared, and supplies the fuel of the part which run short only with the injection fuel quantity from said fuel injection valve 52.
[0038] In spite of according to this 2nd example replacing with an additional fuel injection valve and arranging fuel supply system 22' rather than a throttle valve 32 at the upstream, it is avoidable that inhalation-of-air resistance increases by that fuel supply system 22'.

[0039] Drawing 8 shows the 3rd example of this invention, the fuel supply system 22 which has a throttle valve 32 is connected to the suction port 16 of Engine E so that it may mainly provide the fuel which should be supplied to Engine E, and the additional fuel injection valve 54 is attached in the inhalation-of-air system between a throttle valve 32 and an air cleaner 29.
[0040] And the injection direction of the additional fuel injection valve 54 is set up in the direction corresponding to the center line of the converging section 31 in a fuel supply system 22.
[0041] According to this 3rd example, the fuel from the additional fuel injection valve 54 will be injected towards the fuel sucked out of each fuel extrusion opening 35 -- of the inner circumference of a converging section 31 by airstream in a fuel supply system 22, and it becomes possible to attain equalization of the concentration of the gaseous mixture when making a throttle valve 32 into high opening.
[0042] Drawing 9 shows the 4th example of this invention, and it is set up so that the injection direction of the additional fuel injection valve 54 may pass along the core of a part that each fuel extrusion opening 35 -- is prepared in the converging section 31 by this 4th example to the injection direction of the fuel injection valve 54 of the addition in the 3rd example of the above having been set up in the direction corresponding to the center line of a converging section 31.
[0043] According to this 4th example, as it is not interfered by the throttle valve 32, can make the injection fuel from the fuel injection valve 54 of an addition in the high opening condition of a throttle valve 32 able to collide with an extrusion fuel from each fuel extrusion opening 35 --, and a fuel is made to be able to distribute more effectively, and equalization of the concentration of gaseous mixture can be attained further.
[0044] As mentioned above, although the example of this invention was explained in full detail, this invention can perform various design changes, without deviating from this invention which is not limited to the above-mentioned example and indicated by the claim.
[0045]
[Effect of the Invention] while becoming possible to be able to make the airstream of an inhalation-of-air way, and the fuel sucked out of fuel extrusion opening at an airstream side able to collide mutually, to be able to atomize a fuel effectively, and to reduce fuel consumption as mentioned above according to invention according to claim 1 -- exhaust air -- it becomes possible to improve description and engine power.
[0046] Moreover, according to invention according to claim 2, increase

of ventilation resistance can be avoided and engine power can be improved further.
[0047] if a fuel can be atomized much more effectively and fuel consumption is reduced further, preventing that a fuel adheres to the inner skin of an inhalation-of-air way by making the fuels sucked out of fuel extrusion opening which countered mutually at the airstream side collide, while ** will become possible according to invention according to claim 3 -- exhaust air -- description and engine power can be improved further.
[0048] while becoming possible to become possible to suck a fuel out of fuel extrusion opening effectively to an airstream side with the inhalation-of-air negative pressure in a converging section according to invention according to claim 4, to make the airstream of a converging section, and the fuel sucked out collide mutually furthermore, and to atomize a fuel more effectively and becoming possible to reduce fuel consumption -- exhaust air -- it becomes possible to improve description and engine power.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the notch side elevation showing the inhalation-of-air system of the engine in the 1st example.
[Drawing 2] It is the enlarged vertical longitudinal sectional view of an inhalation-of-air way organizer.
[Drawing 3] It is the 3-3 line sectional view of drawing 2 .
[Drawing 4] a fuel supply pressure and exhaust air -- it is drawing showing the relation of description.
[Drawing 5] fuel-injection timing and exhaust air -- it is drawing

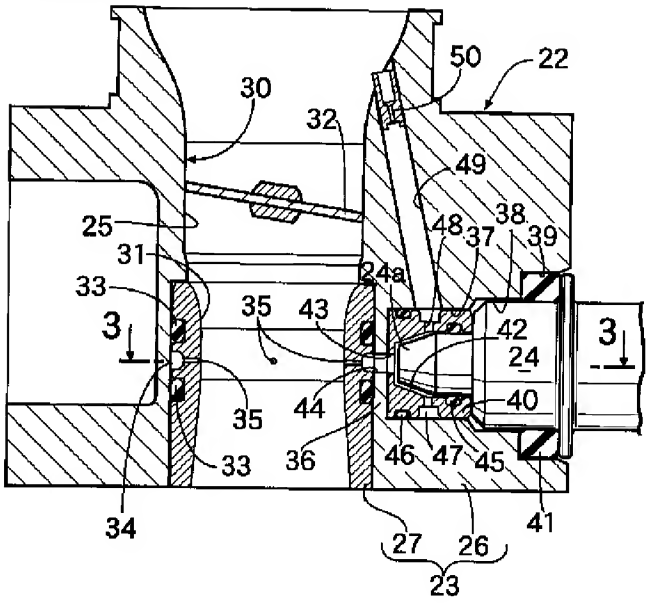
showing the relation of description.
[Drawing 6] brake mean effective pressure and exhaust air -- it is drawing showing the relation of description.
[Drawing 7] It is the notch side elevation showing the inhalation-of-air system of the engine in the 2nd example.
[Drawing 8] It is the notch side elevation showing the inhalation-of-air system of the engine in the 3rd example.
[Drawing 9] It is the notch side elevation showing the inhalation-of-air system of the engine in the 4th example.
[Description of Notations]
22 22' ... Fuel supply system
23 ... Inhalation-of-air way organizer
24 ... Fuel injection valve
29 ... Air cleaner
30 ... Inhalation-of-air way
31 ... Converging section
34 ... Fuel path
35 ... Fuel extrusion opening
49 ... Air-bleed path
E ... Engine

[Translation done.]

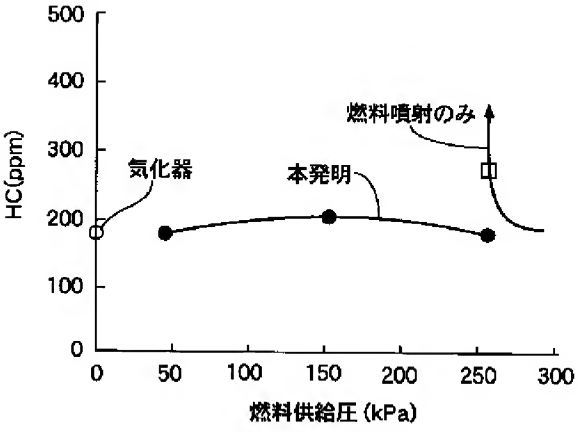
* NOTICES *

DRAWINGS

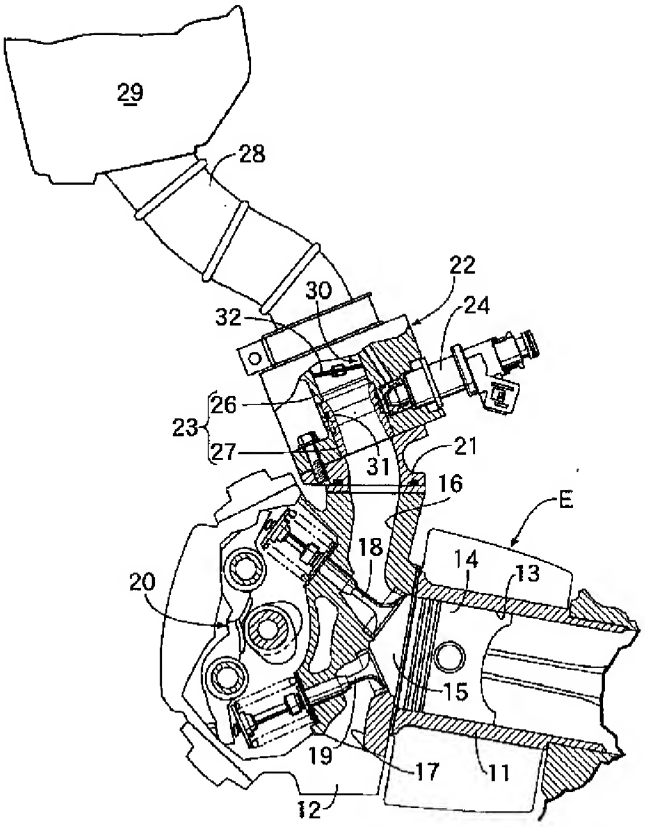
[Drawing 2]



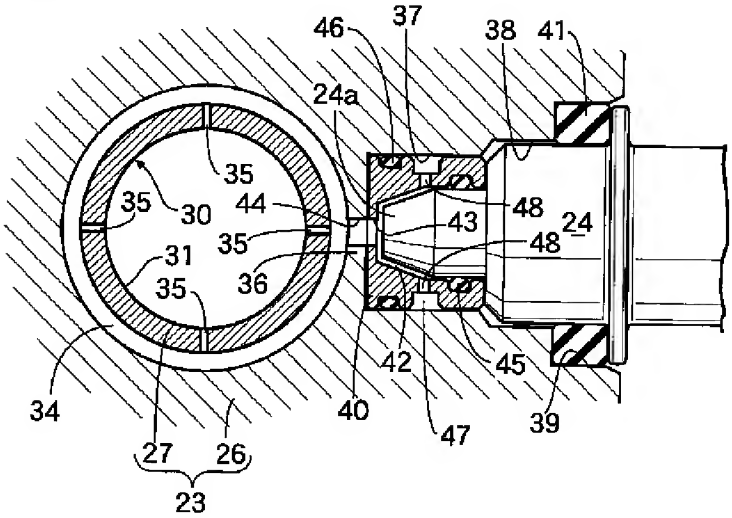
[Drawing 4]



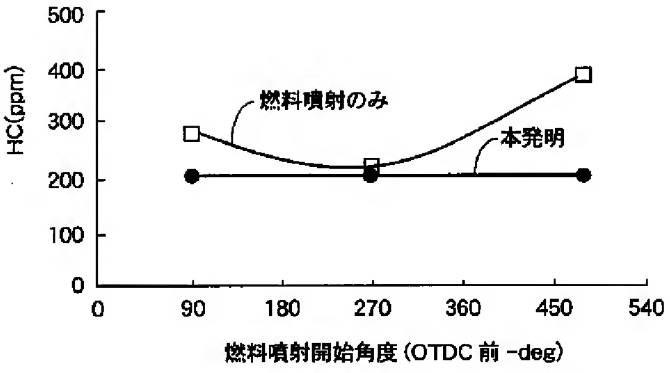
[Drawing 1]



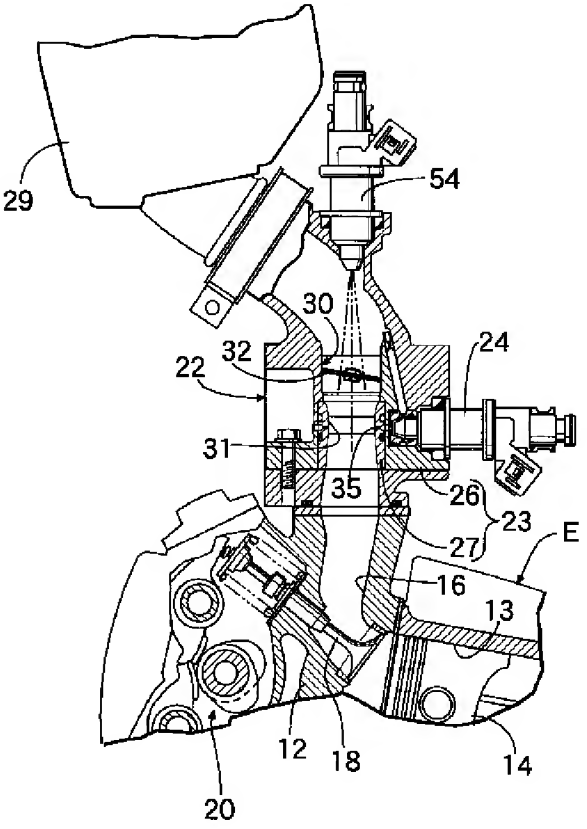
[Drawing 3]



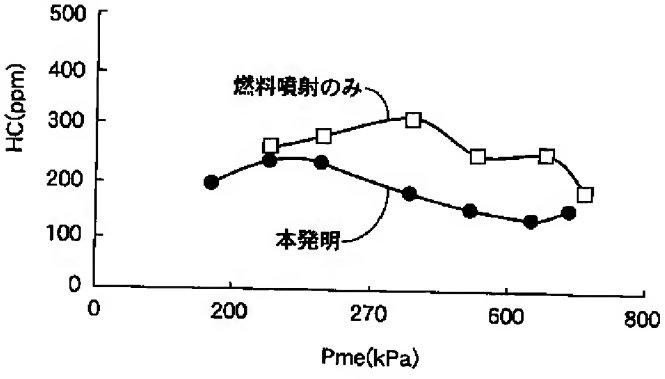
[Drawing 5]



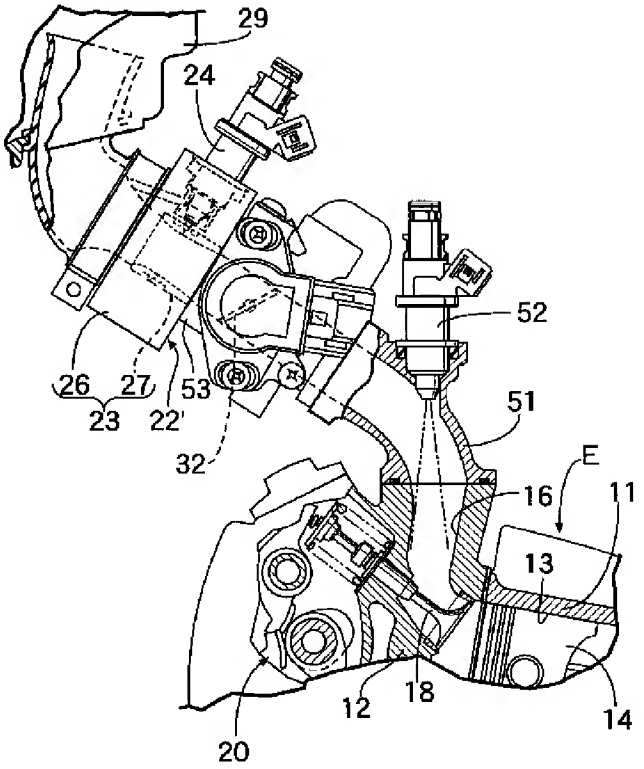
[Drawing 8]



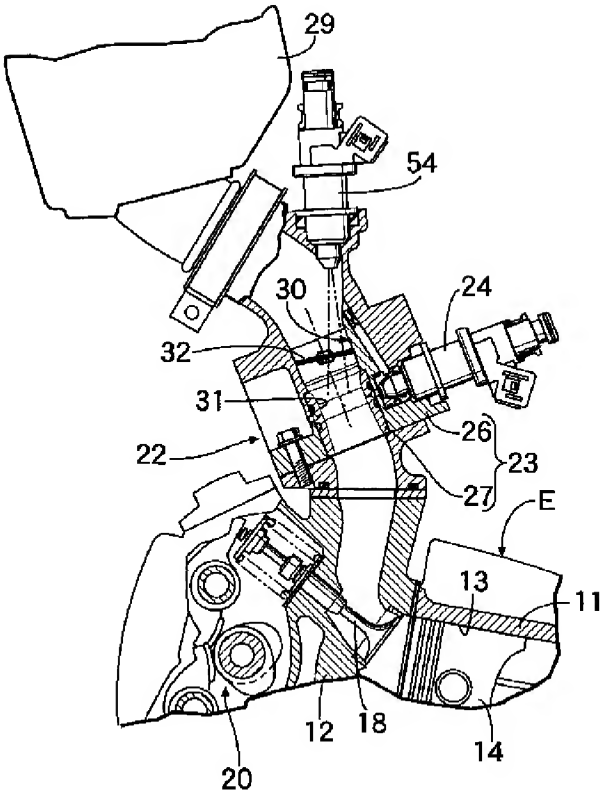
[Drawing 6]



[Drawing 7]



[Drawing 9]



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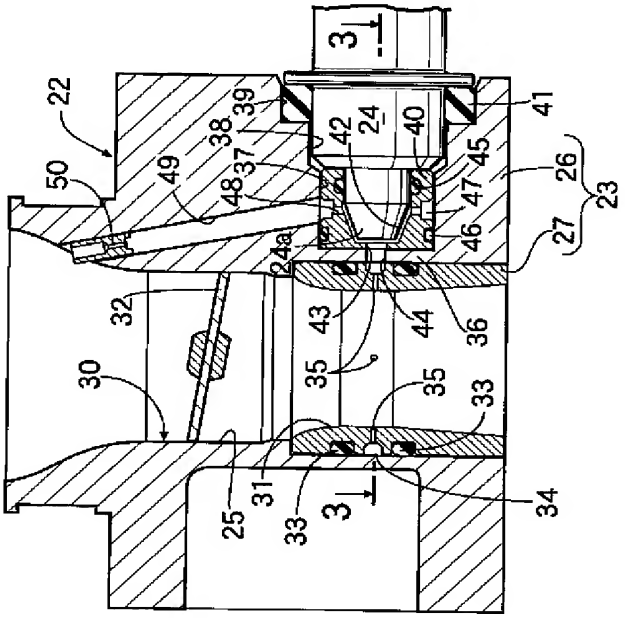
(54)【発明の名称】　エンジンの燃料供給装置

(57)【要約】
【課題】吸気路を形成する吸気路形成体に燃料噴射弁が装着され、燃料噴射弁からの燃料が導かれる燃料通路と、燃料通路に一端を通じさせるとともに他端を吸気路に通じさせる燃料吸い出し口と、燃料吸い出し口よりも上流側で吸気路に一端を通じさせるとともに他端を燃料通路に通じさせたエアブリード通路とが、吸気路形成体に設けられるエンジンの燃料供給装置において、燃料の霧化をより一層促進する。
【解決手段】燃料吸い出し口３５が、吸気路３０を流通する空気流に直交する方向で吸気路３０に開口される。



【特許請求の範囲】
【請求項１】　エアクリーナ（２９）に通じる吸気路（３０）を形成する吸気路形成体（２３）に燃料噴射弁（２４）が装着され、前記燃料噴射弁（２４）からの燃料が導かれる燃料通路（３４）と、該燃料通路（３４）に一端を通じさせるとともに他端を前記吸気路（３０）に通じさせる燃料吸い出し口（３５）と、前記燃料吸い出し口（３５）よりも上流側で吸気路（３０）に一端を通じさせるとともに他端を前記燃料通路（３４）に通じさせたエアブリード通路（４９）とが、前記吸気路形成体（２３）に設けられるエンジンの燃料供給装置において、前記燃料吸い出し口（３５）の他端が、前記吸気路（３０）を流通する空気流に直交する方向で前記吸気路（３０）に開口されることを特徴とするエンジンの燃料供給装置。
【請求項２】　前記燃料吸い出し口（３５）が吸気路（３０）の内周面に開口して吸気路形成体（２３）に設けられることを特徴とする請求項１記載のエンジンの燃料供給装置。
【請求項３】　複数の前記燃料吸い出し口（３５）の他端が、相互に対向した位置で前記吸気路（３０）の内周面に開口されることを特徴とする請求項２記載のエンジンの燃料供給装置。
【請求項４】　エアクリーナ（２９）に通じる吸気路（３０）を形成する吸気路形成体（２３）に燃料噴射弁（２４）が装着され、前記燃料噴射弁（２４）からの燃料が導かれる燃料通路（３４）と、該燃料通路（３４）に一端を通じさせるとともに他端を前記吸気路（３０）に通じさせる燃料吸い出し口（３５）と、前記燃料吸い出し口（３５）よりも上流側で吸気路（３０）に一端を通じさせるとともに他端を前記燃料通路（３４）に通じさせたエアブリード通路（４９）とが、前記吸気路形成体（２３）に設けられるエンジンの燃料供給装置において、前記吸気路（３０）の一部を構成する絞り部（３１）が、該絞り部（３１）の上流側の吸気路（３０）よりも内周直径を小さくして前記吸気路形成体（２３）に設けられ、前記燃料吸い出し口（３５）の他端が、前記絞り部（３１）を流通する空気流に直交する方向で前記絞り部（３１）の内周面に開口されることを特徴とするエンジンの燃料供給装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、エアクリーナに通じる吸気路を形成する吸気路形成体に燃料噴射弁が装着され、前記燃料噴射弁からの燃料が導かれる燃料通路と、該燃料通路に一端を通じさせるとともに他端を前記吸気路に通じさせる燃料吸い出し口と、前記燃料吸い出し口よりも上流側で吸気路に一端を通じさせるとともに他端を前記燃料通路に通じさせたエアブリード通路とが、前記吸気路形成体に設けられるエンジンの燃料供給装置に関する。
【０００２】
【従来の技術】従来、かかる燃料供給装置は、たとえば特開平５－２６１３２号公報等で既に知られている。
【０００３】
【発明が解決しようとする課題】ところで、このような燃料供給装置は、吸気路を流通する空気流で燃料噴射弁から供給される燃料を吸い出して霧化するとともに、エアブリード通路からのアシストエアで燃料の霧化を促進するようにしたものであり、燃料噴射弁の噴射圧を低下させることを可能とするとともに燃料噴射弁の燃料噴射タイミングを高精度に制御することを不要とするものである。しかるに、上記従来のものでは、燃料吸い出し口が、吸気路内の空気流の流れ方向下流側に向けて開口されており、空気流中での燃料の霧化が良好であるとは言い難く、燃費の低減、排気性状の向上およびエンジン出力向上を図るために燃料の霧化をより一層促進することが望まれる。
【０００４】本発明は、かかる事情に鑑みてなされたものであり、燃料の霧化をより一層促進し得るようにしたエンジンの燃料供給装置を提供することを目的とする。
【０００５】
【課題を解決するための手段】上記目的を達成するために、請求項１記載の発明は、エアクリーナに通じる吸気路を形成する吸気路形成体に燃料噴射弁が装着され、前記燃料噴射弁からの燃料が導かれる燃料通路と、該燃料通路に一端を通じさせるとともに他端を前記吸気路に通じさせる燃料吸い出し口と、前記燃料吸い出し口よりも上流側で吸気路に一端を通じさせるとともに他端を前記燃料通路に通じさせたエアブリード通路とが、前記吸気路形成体に設けられるエンジンの燃料供給装置において、前記燃料吸い出し口の他端が、前記吸気路を流通する空気流に直交する方向で前記吸気路に開口されることを特徴とする。
【０００６】このような請求項１記載の発明の構成によれば、燃料吸い出し口が吸気路の空気流と直交する方向で開口していることにより、空気流と、燃料吸い出し口から空気流側に吸い出される燃料とが相互に衝突して燃料が効果的に霧化されることになり、燃料の霧化が促進されることで、燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。
【０００７】また請求項２記載の発明は、上記請求項１記載の発明の構成に加えて、前記燃料吸い出し口が吸気路の内周面に開口して吸気路形成体に設けられることを特徴とし、かかる構成によれば、燃料吸い出し口の配置に伴なって吸気路内に流れを妨げる構造が設けられることがなく、通気抵抗の増大を回避することができ、エンジン出力をより一層向上することができる。
【０００８】請求項３記載の発明は、上記請求項２記載

の発明の構成に加えて、複数の前記燃料吸い出し口の他端が、相互に対向した位置で前記吸気路の内周面に開口されることを特徴とし、かかる構成によれば、相互に対向した燃料吸い出し口から空気流側に吸い出された燃料同士を衝突させることにより、燃料が吸気路の内周面に付着してしまうことを防止しつつ燃料をより一層効果的に霧化することができ、燃費をより一層低減するとが可能となるとともに、排気性状およびエンジン出力をより一層向上することができる。

【０００９】さらに請求項４記載の発明は、エアクリーナに通じる吸気路を形成する吸気路形成体に燃料噴射弁が装着され、前記燃料噴射弁からの燃料が導かれる燃料通路と、該燃料通路に一端を通じさせるとともに他端を前記吸気路に通じさせる燃料吸い出し口と、前記燃料吸い出し口よりも上流側で吸気路に一端を通じさせるとともに他端を前記燃料通路に通じさせたエアブリード通路とが、前記吸気路形成体に設けられるエンジンの燃料供給装置において、前記吸気路の一部を構成する絞り部が該絞り部の上流側の吸気路よりも内周直径を小さくして前記吸気路形成体に設けられ、前記燃料吸い出し口の他端が、前記絞り部を流通する空気流に直交する方向で前記絞り部の内周面に開口されることを特徴とする。

【００１０】このような請求項４記載の発明の構成によれば、燃料吸い出し口が吸気路の空気流と直交する方向で絞り部の内周面に開口していることにより、絞り部での吸気負圧により燃料吸い出し口から空気流側に燃料を効果的に吸い出すことが可能となり、空気流と、吸い出される燃料とを相互に衝突させて燃料をより効果的に霧化することが可能となり、燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【００１１】

【発明の実施の形態】以下、本発明の実施の形態を、添付の図面に示した本発明の実施例に基づいて説明する。

【００１２】図１～図６は本発明の第１実施例を示すものであり、図１はエンジンの吸気系を示す切欠き側面図、図２は吸気路形成体の拡大縦断面図、図３は図２の３－３線断面図、図４は燃料供給圧および排気性状の関係を示す図、図５は燃料噴射タイミングおよび排気性状の関係を示す図、図６は正味平均有効圧力および排気性状の関係を示す図である。

【００１３】先ず図１において、エンジンＥは、シリンダブロック１１と、該シリンダブロック１１に結合されるシリンダヘッド１２とを備え、シリンダブロック１１が備えるシリンダボア１３に摺動自在に嵌合されるピストン１４と、シリンダヘッド１２との間に燃焼室１５が形成される。

【００１４】シリンダヘッド１２には燃焼室１５に連通可能な吸気ポート１６および排気ポート１７が設けられるとともに、吸気ポート１６および燃焼室１５間の連通・遮断を切換える吸気弁１８ならびに排気ポート１７および燃焼室１５間の連通・遮断を切換える排気弁１９が開閉作動可能に支承されており、吸気弁１８および排気弁１９は、従来周知の動弁機構２０で開閉駆動される。

【００１５】前記吸気ポート１６には吸気管２１を介して燃料供給装置２２が接続される。この燃料供給装置２２は、吸気路形成体２３と、該吸気路形成体２３に装着される燃料噴射弁２４とを備える。

【００１６】図２において、吸気路形成体２３は、通路２５を有する吸気路主形成部材２６と、前記通路２５の下流側に嵌合されて吸気路主形成部材２６に固定される絞り部材２７とから成るものであり、この吸気路形成体２３は、吸気ホース２８を介してエアクリーナ２９に上流端が連通されるとともに下流端が吸気管２１に連通される吸気路３０を備える。吸気路３０は、前記通路２５のうち絞り部材２７が嵌合される部分を除く部分と、絞り部材２７の内面で形成される絞り部３１とで構成されるものであり、絞り部３１は、該絞り部３１よりも上流側の吸気路３０すなわち通路２５よりも内周直径を小さくして形成されている。

【００１７】前記絞り部３１よりも上流側で吸気路形成体２３の吸気路主形成部材２６には、吸気路３０の開度を制御するバタフライ形のスロットル弁３２が回動可能に支承される。

【００１８】図３を併せて参照して、絞り部材２７の外周には環状溝が設けられるとともに、その環状溝を両側から挟む一対の環状のシール部材３３，３３が装着されており、絞り部材２７を吸気路主形成部材２６に嵌合、固定した状態で絞り部材２７および吸気路主形成部材２６間には前記環状溝により環状の燃料通路３４が形成され、該燃料通路３４の両側は吸気路主形成部材２６および絞り部材２７間に介装されるシール部材３３，３３でシールされる。すなわち絞り部３１に対応する部分で吸気路３０を同心に囲繞する環状の燃料通路３４が吸気路形成体２３に設けられる。

【００１９】絞り部材２７には、燃料通路３４に一端を通じさせるとともに絞り部３１の内面に他端を開口させる複数たとえば４つの燃料吸い出し口３５，３５…が、それらの燃料吸い出し口３５，３５…の他端開口部を相互に対向させるようにして設けられる。しかも各燃料吸い出し口３５，３５…は、絞り部３１の軸線に直交する平面内に配置されるものであり、各燃料吸い出し口３５，３５…の他端は、絞り部３１を流通する空気流の流れ方向に対して直交する方向で絞り部３１の内面に開口される。

【００２０】吸気路形成体２３における吸気路主形成部材２６において絞り部材２７に対応する部分には、内端に端壁３６を有する小径孔３７と、該小径孔３７よりも大径に形成されて小径孔３７の外端に内端を同軸に連ならせた中径孔３８と、該中径孔３８よりも大径に形成さ

れて中径孔３８の外端に内端を同軸に連ならせるとともに外端を開口した大径孔３９とが設けられており、小径孔３７には、内端を閉じた有底円筒状のカラー４０が嵌合される。

【００２１】燃料噴射弁２４の先端部は、大径孔３９との間に環状のシール部材４１を介在させて前記中径孔３８および大径孔３９に挿入される。しかも燃料噴射弁２４が先端に備える円筒状の燃料噴出ノズル２４ａは前記カラー４０に嵌合される。

【００２２】燃料噴出ノズル２４ａおよびカラー４０間にはブリード室４２が形成され、このブリード室４２は、カラー４０の先端閉塞部に設けられた連通孔４３と、該連通孔４３と同軸にして端壁３６に設けられた連通孔４４とを介して燃料通路３４に連通される。しかもカラー４０の外端部および燃料噴出ノズル２４ａ間には環状のシール部材４５が介装され、カラー４０の内端部外面には、小径孔３７の内面に弾発接触する環状のシール部材４６が装着されている。

【００２３】カラー４０の中間部外面には小径孔３７の内面との間に環状室４７を形成するための環状凹部が設けられており、環状室４７およびブリード室４２間を連通させる複数の連通孔４８，４８…がカラー４０に設けられる。

【００２４】吸気路形成体２３の吸気路主形成部材２６には、前記各燃料吸い出し口３５，３５…よりも上流側、この実施例ではスロットル弁３２よりも上流側で吸気路３０に一端を通じさせるエアブリード通路４９が、その他端を前記環状室４７に通じさせるようにして設けられており、該エアブリード通路４９の一端部にはエアジェット５０が圧入される。すなわちスロットル弁３２よりも上流側の吸気路３０にエアジェット５０を介して一端を連通させたエアブリード通路４９の他端は、環状室４７、連通孔４８，４８…、ブリード室４２および連通孔４３，４４を介して燃料通路３４に連通する。

【００２５】次にこの第１実施例の作用について説明すると、燃料噴射弁２４から噴射される燃料は、ブリード室４２内でエアジェット５０で計量されつつエアブリード通路４９から供給されるアシストエアと混合されて燃料通路３４に導かれ、吸気路３０を流通する空気流によって各燃料吸い出し口３５，３５…から吸気路３０に吸い出されて霧化される。しかも各燃料吸い出し口３５，３５…は、吸気路３０を流通する空気流に直交する方向で吸気路３０に開口されており、吸気路３０を流通する空気流と、燃料吸い出し口３５，３５…から空気流側に吸い出される燃料とが相互に衝突して燃料が効果的に霧化されることになり、燃料の霧化が促進されることで、エンジンＥの燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【００２６】また燃料吸い出し口３５，３５…が吸気路３０の内周面に開口しているので、燃料吸い出し口３５，３５…の配置に伴なって吸気路３０内に流れを妨げる構造が設けられることがない。したがって吸気路３０での通気抵抗の増大を回避することができ、エンジン出力をより一層向上することができる。

【００２７】さらに燃料吸い出し口３５，３５…が、相互に対向した位置で吸気路３０の内周面に開口されているので、相互に対向した燃料吸い出し口３５，３５…から空気流側に吸い出された燃料同士を衝突させることにより、燃料が吸気路３０の内周面に付着してしまうことを防止しつつ燃料をより一層効果的に霧化することができ、燃費をより一層低減するとが可能となるとともに、排気性状およびエンジン出力をより一層向上することができる。

【００２８】特に吸気路３０の一部を構成する絞り部３１が該絞り部３１よりも上流側の吸気路３０よりも内周直径を小さくして吸気路形成体２３に設けられており、燃料吸い出し口３５，３５…が、絞り部３１を流通する空気流に直交する方向で絞り部３１の内周面に開口されるので、絞り部３１での吸気負圧により燃料吸い出し口３５，３５…から空気流側に燃料をより効果的に吸い出すことが可能となり、燃費をより一層低減することが可能となるとともに、排気性状およびエンジン出力をより一層向上することが可能となる。

【００２９】このような本発明に従う燃料供給装置２２、ならびに燃料噴射弁からの燃料噴射のみによる燃料供給装置２２の排気性状を、エンジン回転数４０００ｒｐｍ、正味平均有効圧力P_{me}４００ｋＰａの運転状態において燃料供給圧を変化させて比べると、図４で示すようになり、本発明に従う燃料供給装置２２では燃料噴射弁２４への燃料供給圧を０ｋＰａ近傍まで低下させても排気ガス中のＨＣ濃度を従来の気化器と同等の１８０ｐｐｍ程度に抑え得る噴霧性状が得られるのに対し、燃料噴射弁からの燃料噴射のみによる燃料供給装置２２では燃料供給圧が２５０ｋＰａが下限値である。すなわち燃料噴射弁からの燃料噴射のみによる燃料供給では、燃料供給圧を２５０ｋＰａ以上に設定しなければ燃料を充分に霧化し得ないのに対し、本発明に従う燃料供給装置２２では燃料供給圧を０ｋＰａ近傍まで低下させても燃料を充分に霧化することが可能となるのである。

【００３０】したがって燃料噴射弁２４に接続される燃料ポンプの小型化および消費電力の低減を図ることが可能となるとともに、燃料噴射弁２４および燃料ポンプ間に設けられる燃料配管のコストダウンを図ることが可能となる。また燃料ポンプを用いずに、燃料噴射弁２４の上方に配置される燃料タンクからのヘッド圧だけで燃料を燃料噴射弁２４に燃料を供給するようにし、燃料噴射弁２４のオン・オフで燃料を計量するようにしてもよい。

【００３１】このように燃料の霧化を充分に行なうこと

ができるので、吸気通路形成体２２から吸気ポート１６までの吸気管長を短縮することが可能であり、吸気系を含むエンジン全体の小型化を図ることが可能となる。

【００３２】燃料噴射弁２４は燃料通路３４に燃料を供給し得る姿勢であればどのような姿勢で吸気路形成体２３に装着されてもよく、燃料噴射弁２４の配置上の自由度を増大することができる。但し、この実施例のように、吸気路３０の軸線と直交する姿勢で燃料噴射弁２４を吸気路形成体２３に装着すれば、吸気系を短縮して吸気系を含むエンジン全体の小型化を図ることができる。

【００３３】また本発明に従う燃料供給装置２２、ならびに燃料噴射弁からの燃料噴射のみによる燃料供給装置２２の排気性状を、エンジン回転数４０００ｒｐｍ、正味平均有効圧力P_{me}４００ｋＰａの運転状態において燃料噴射タイミング（ＯＴＤＣ前のクランク角度）を変化させて比べると、図５で示すようになる。この図５から明らかなように、本発明に従う燃料供給装置２２では燃料噴射弁２４の噴射タイミングを変化させても排気性状に変化がないのに対し、燃料噴射弁からの燃料噴射のみによる燃料供給装置２２では噴射タイミングの変化に応じて排気性状が変化してしまう。すなわち本発明に従う燃料供給装置２２では、燃料はエンジンＥの運転状態に応じた吸気負圧によって計量されて吸気路３０に吸い出されるものであり、燃料噴射弁２４は、吸気路３０に吸い出される量に応じた燃料を供給すればよいので、燃料噴射弁２４の噴射タイミングを高精度に制御しなくとも燃料を充分に霧化して良好な排気性状を得ることが可能であ。しかるに燃料噴射弁からの燃料噴射のみによる燃料供給では、燃料噴射タイミングを高精度に制御しなければ燃料の充分な霧化が得られず、排気性状も悪化してしまうのである。

【００３４】さらに本発明に従う燃料供給装置２２、ならびに燃料噴射弁からの燃料噴射のみによる燃料供給装置２２の排気性状を、エンジン回転数を２０００ｒｐｍの低回転とした運転状態において、正味平均有効圧力P_{me}を変化させて比べると、図６で示すようになる。この図６で明らかなように、本発明に従う燃料供給装置２２では、正味平均有効圧力P_{me}が低いとき、すなわちエンジンＥが２０００ｒｐｍの低速回転でしかも高負荷で運転されているときに、燃料を充分に霧化して良好な排気性状が得られるのに対し、燃料噴射弁からの燃料噴射のみによる燃料供給では燃料を充分に霧化することができず、排気性状の劣化を招くことになる。すなわち本発明に従う燃料供給装置２２では、アシストエアによる霧化も行なわれるので、高負荷、低回転の運転状態でも燃料を充分に霧化することができるのである。

【００３５】ところで、燃料噴射弁を用いて燃料を供給するようにした従来のエンジンにおいて、スロットル弁のアイドル開度から全開開度までの広い運転域にわたって１つの燃料噴射弁で燃料供給をまかなうことが困難であることにより、スロットル弁よりも上流側に追加の燃料噴射弁を配設することがあるが、本発明に従う燃料供給装置を上記追加の燃料噴射弁に代えて用いることも可能であり、そのような場合の吸気系の構成を次の第２実施例で説明する。

【００３６】図７において、エンジンＥの吸気ポート１６に接続される吸気管５３には、エンジンＥに供給すべき燃料を主としてまかなう燃料噴射弁５２が取付けられ、吸気管５３は、スロットル弁３２を備えるスロットルボディ５１および燃料供給装置２２′を介してエアクリーナ２９に接続される。

【００３７】燃料供給装置２２′は、スロットル弁が設けられないことを除いて上記第１実施例の燃料供給装置２２と同様に構成されるものであり、前記燃料噴射弁５２からの噴射燃料量だけでは不足する分の燃料を供給するものである。

【００３８】この第２実施例によれば、追加の燃料噴射弁に代えてスロットル弁３２よりも上流側に燃料供給装置２２′が配置されるにもかかわらず、その燃料供給装置２２′によって吸気抵抗が増加することを回避することができる。

【００３９】図８は本発明の第３実施例を示すものであり、スロットル弁３２を有する燃料供給装置２２が、エンジンＥに供給すべき燃料を主としてまかなうべくエンジンＥの吸気ポート１６に接続され、追加の燃料噴射弁５４がスロットル弁３２およびエアクリーナ２９間の吸気系に取付けられる。

【００４０】しかも追加の燃料噴射弁５４の噴射方向は、燃料供給装置２２における絞り部３１の中心線に合致した方向に設定されている。

【００４１】この第３実施例によれば、燃料供給装置２２において絞り部３１の内周の各燃料吸い出し口３５…から空気流に吸い出される燃料に向けて追加の燃料噴射弁５４からの燃料が噴射されることになり、スロットル弁３２を高開度としたときの混合気の濃度の均一化を図ることが可能となる。

【００４２】図９は本発明の第４実施例を示すものであり、上記第３実施例における追加の燃料噴射弁５４の噴射方向が絞り部３１の中心線に合致した方向に設定されていたのに対し、この第４実施例では、追加の燃料噴射弁５４の噴射方向が絞り部３１において各燃料吸い出し口３５…が設けられている部分の中心を通るように設定される。

【００４３】この第４実施例によれば、スロットル弁３２の高開度状態で追加の燃料噴射弁５４からの噴射燃料をスロットル弁３２に邪魔されないようにして、各燃料吸い出し口３５…からの吸い出し燃料に衝突させて燃料をより効果的に分散せしめ、混合気の濃度の均一化をより一層図ることができる。

【００４４】以上、本発明の実施例を詳述したが、本発

明は上記実施例に限定されるものではなく、特許請求の範囲に記載された本発明を逸脱することなく種々の設計変更を行なうことが可能である。

【００４５】

【発明の効果】以上のように請求項１記載の発明によれば、吸気路の空気流と、燃料吸い出し口から空気流側に吸い出される燃料とを相互に衝突させて燃料を効果的に霧化することができ、燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【００４６】また請求項２記載の発明によれば、通気抵抗の増大を回避することができ、エンジン出力をより一層向上することができる。

【００４７】請求項３記載の発明によれば、相互に対向した燃料吸い出し口から空気流側に吸い出された燃料同士を衝突させることにより、燃料が吸気路の内周面に付着してしまうことを防止しつつ燃料をより一層効果的に霧化することができ、燃費をより一層低減するとが可能となるとともに、排気性状およびエンジン出力をより一層向上することができる。

【００４８】さらに請求項４記載の発明によれば、絞り部での吸気負圧により燃料吸い出し口から空気流側に燃料を効果的に吸い出すことが可能となり、絞り部の空気流と、吸い出される燃料とを相互に衝突させて燃料をより効果的に霧化することが可能となり、燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【図面の簡単な説明】

【図１】第１実施例でのエンジンの吸気系を示す切欠き側面図である。

【図２】吸気路形成体の拡大縦断面図である。

【図３】図２の３－３線断面図である。

【図４】燃料供給圧および排気性状の関係を示す図である。

【図５】燃料噴射タイミングおよび排気性状の関係を示す図である。

【図６】正味平均有効圧力および排気性状の関係を示す図である。

【図７】第２実施例でのエンジンの吸気系を示す切欠き側面図である。

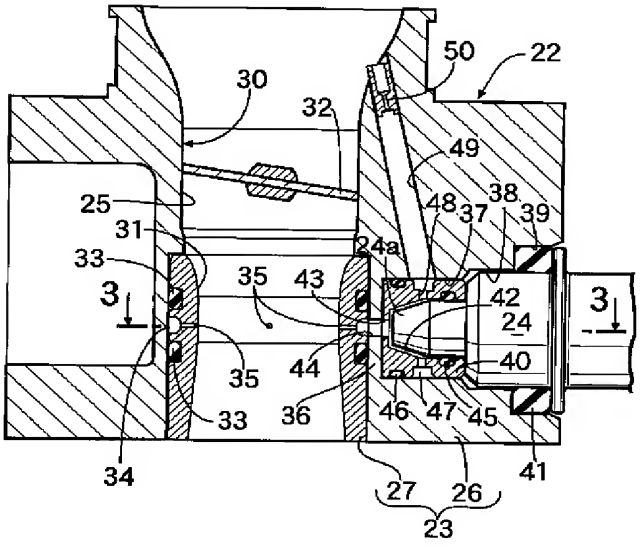
【図８】第３実施例でのエンジンの吸気系を示す切欠き側面図である。

【図９】第４実施例でのエンジンの吸気系を示す切欠き側面図である。

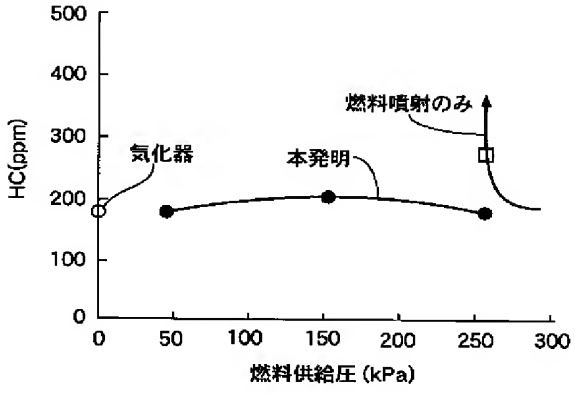
【符号の説明】

２２，２２′・・・燃料供給装置
２３・・・吸気路形成体
２４・・・燃料噴射弁
２９・・・エアクリーナ
３０・・・吸気路
３１・・・絞り部
３４・・・燃料通路
３５・・・燃料吸い出し口
４９・・・エアブリード通路
Ｅ・・・エンジン

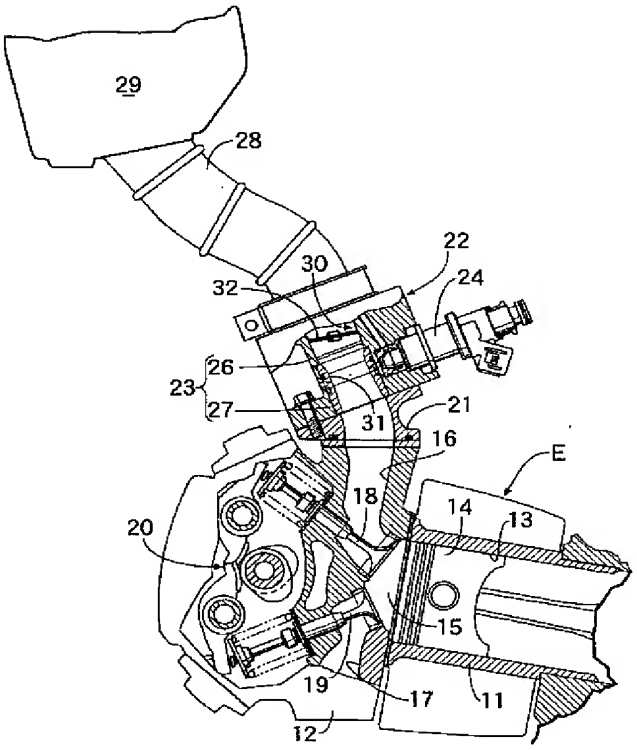
【図２】



【図４】



【図1】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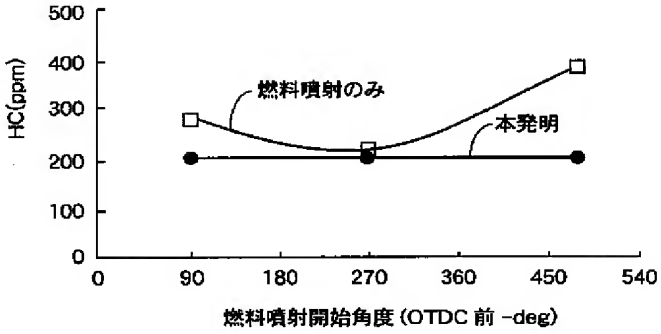
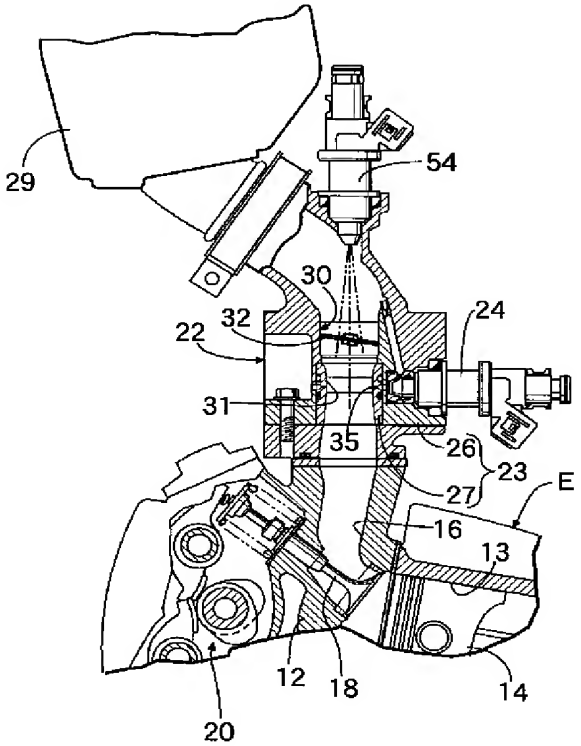
【図5】


500
400
300
200
100
0
HC(ppm)
燃料噴射のみ
本発明
0
90
180
270
360
450
540
燃料噴射開始角度 (OTDC 前 -deg)

【図8】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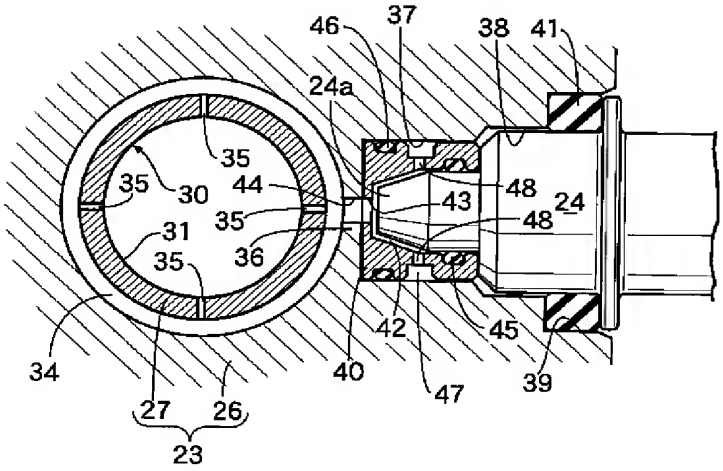
【図3】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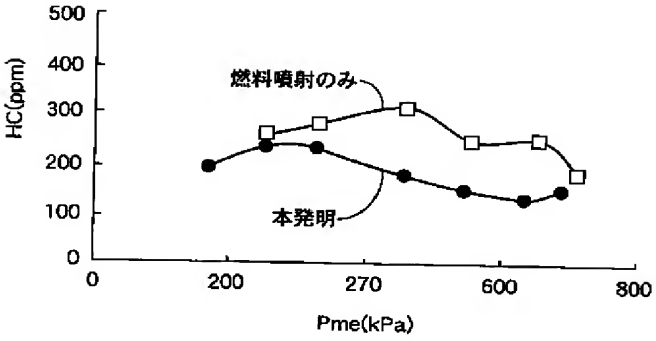
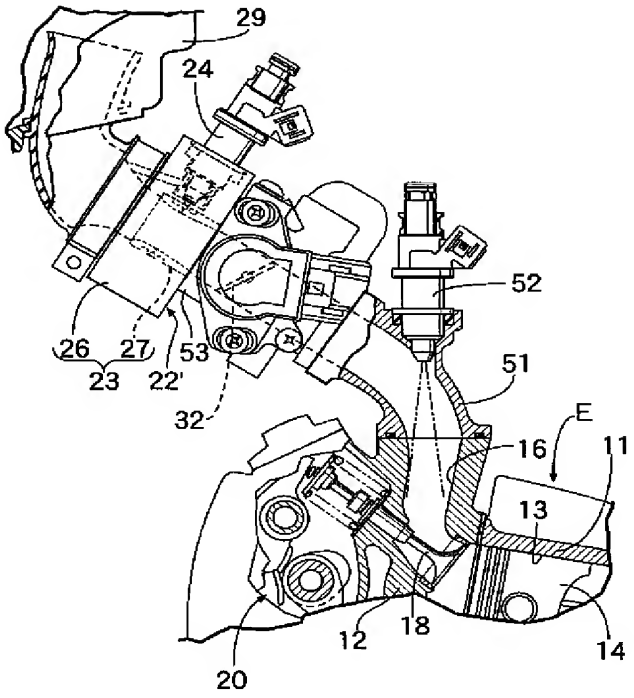
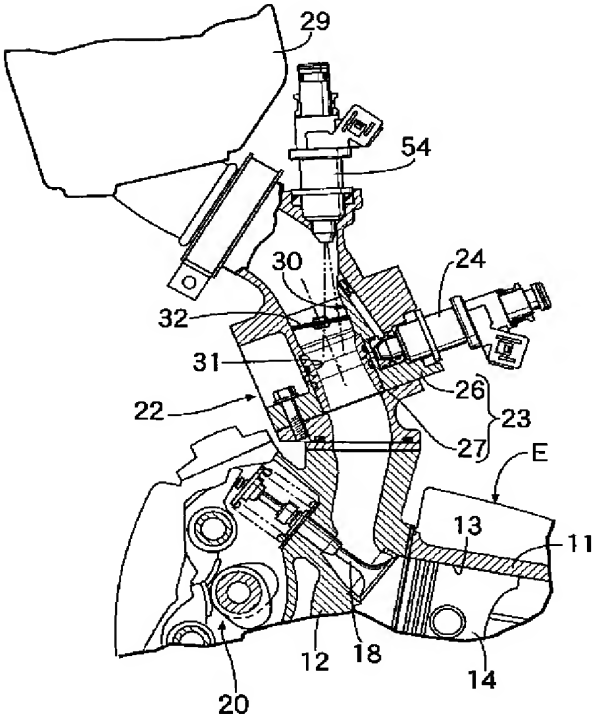
【図6】


500
400
300
200
100
0
HC(ppm)
燃料噴射のみ
本発明
0
200
270
600
800
Pme(kPa)

【図7】


29
24
52
26
27
53
22'
23
51
32
E
16
11
13
12
18
14
20

【図9】


29
54
30
24
32
31
22
26
23
27
E
13
11
12
18
14
20